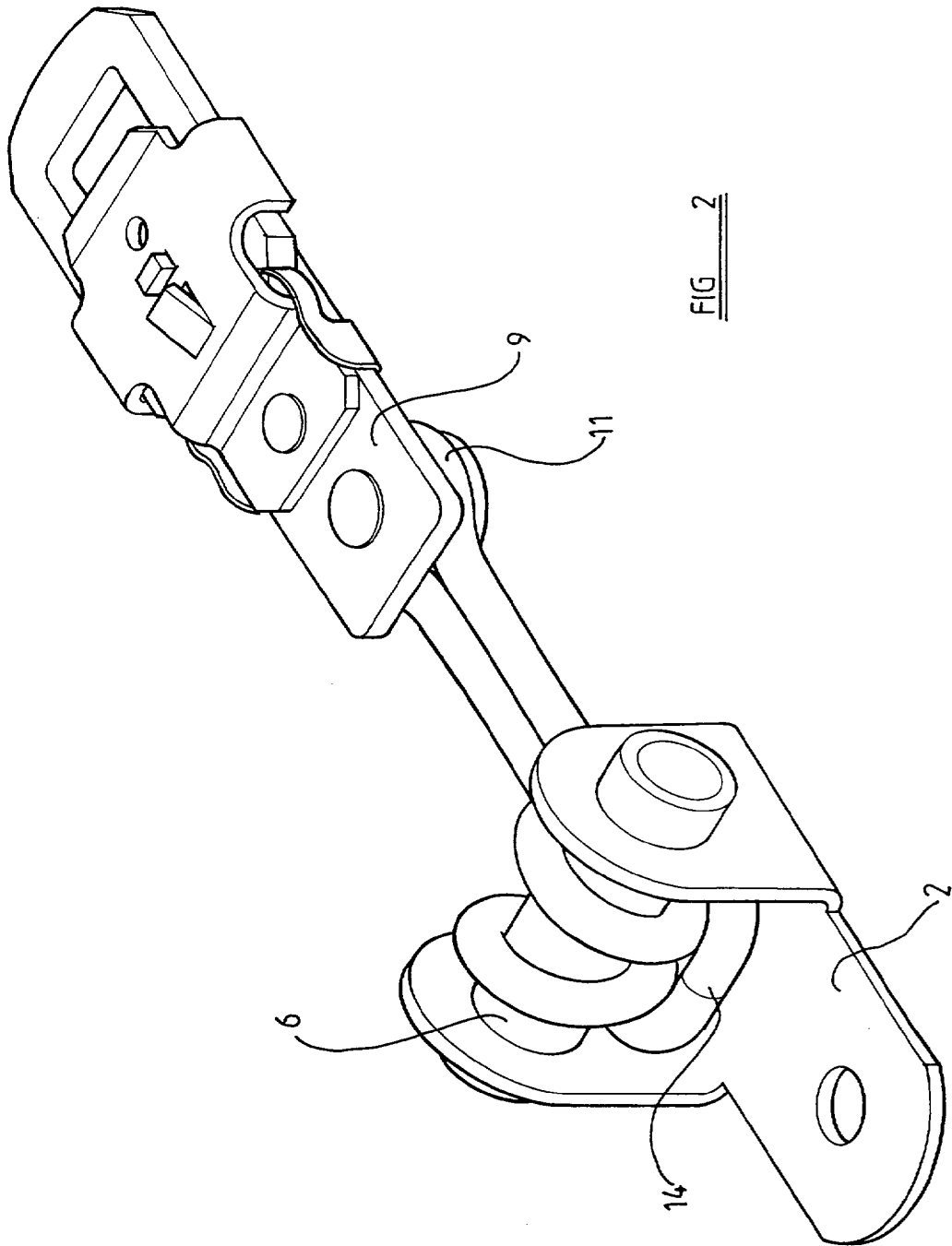
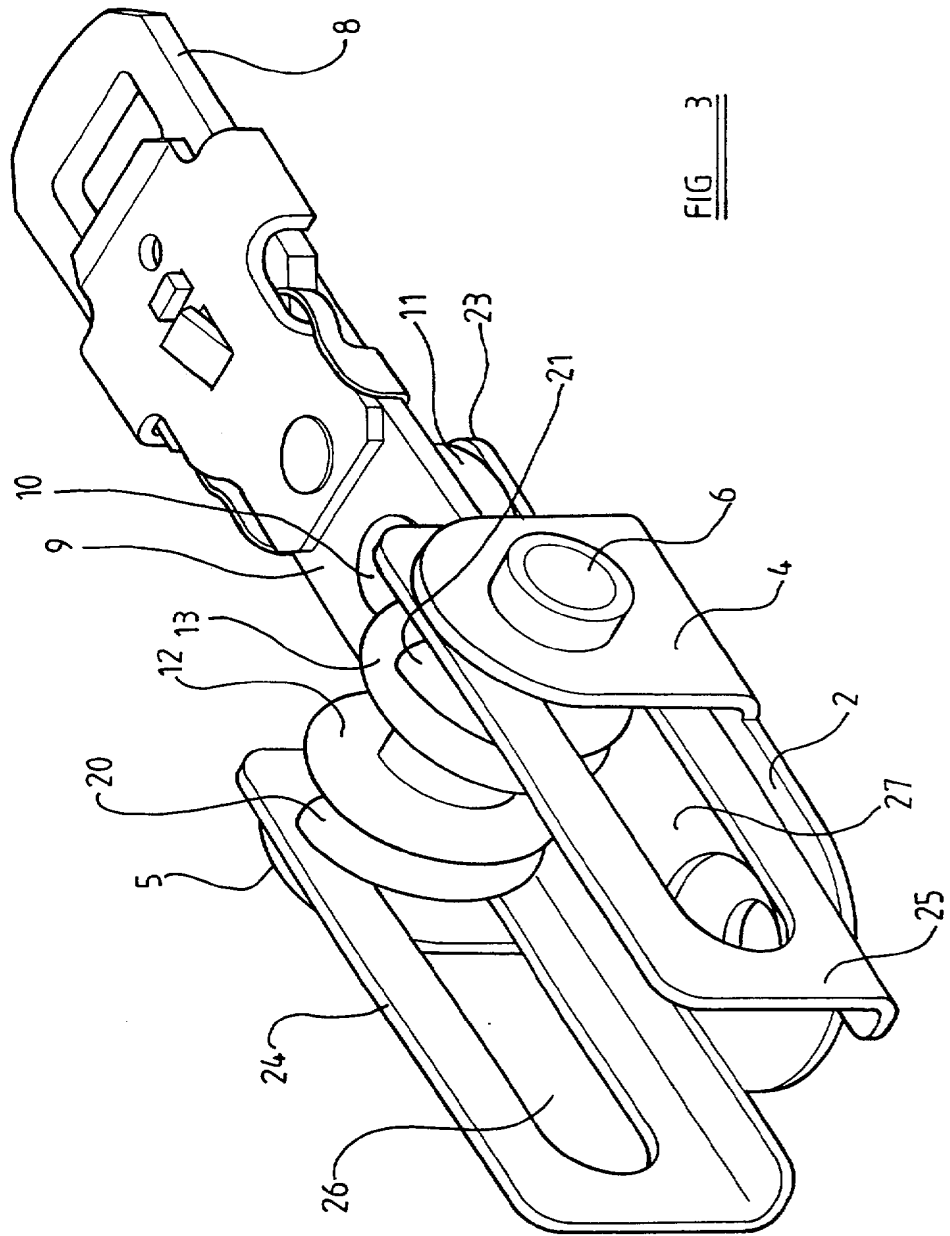


(58) Field of Search
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Online WPI

FIG 3





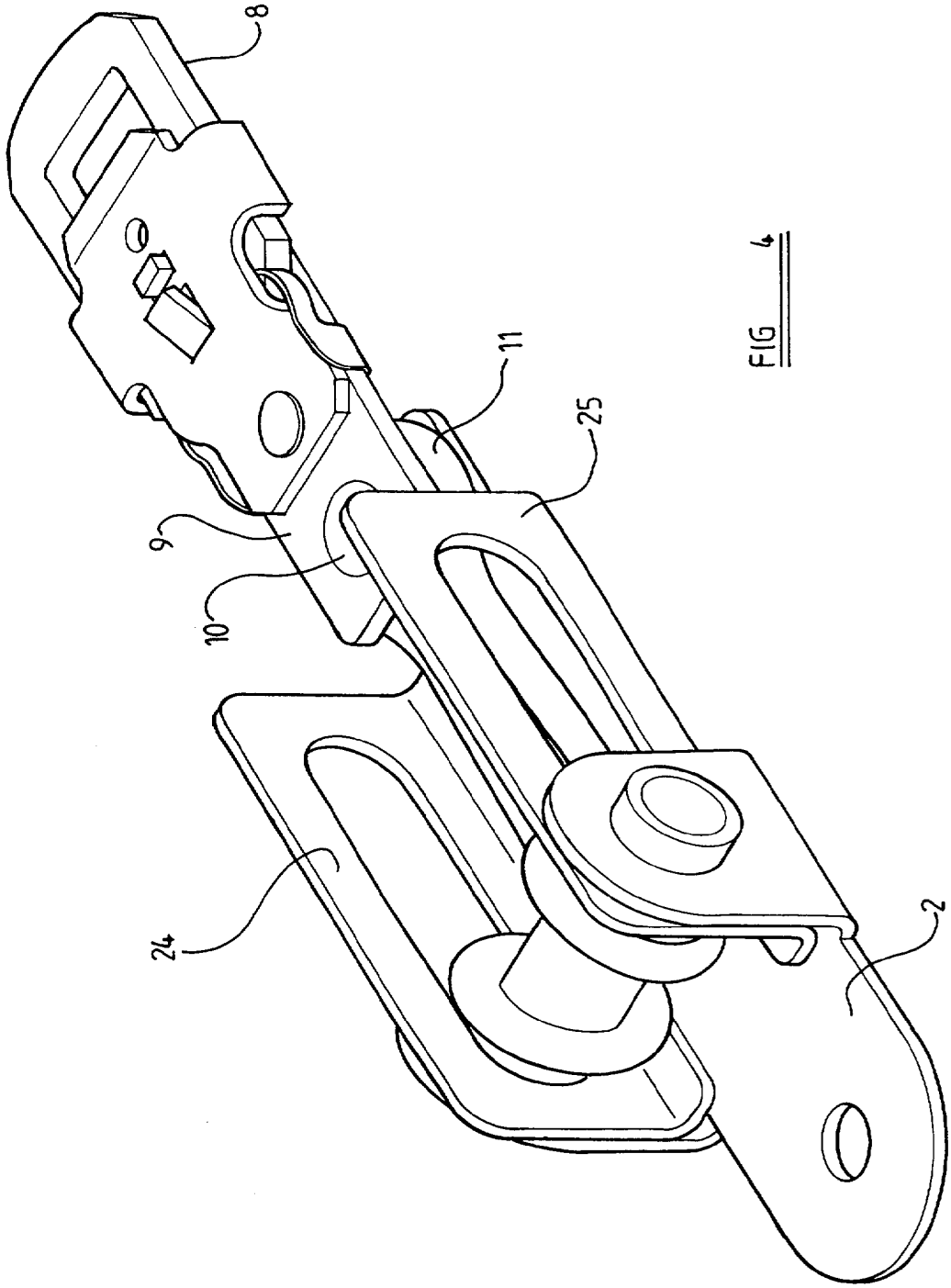


FIG 4

DESCRIPTION OF INVENTION

“IMPROVEMENTS IN OR RELATING TO A FORCE LIMITER”

THE PRESENT INVENTION relates to a force limiter, and more particularly relates to a force limiter adapted to be mounted in position between a mounting point provided as an anchoring point on the chassis of a motor vehicle, and a mounting point on a safety device in a motor vehicle, such as a retractor reel or a buckle for use with a seat belt.

It has been proposed before to provide a force limiter in position between a fixed point on the chassis of a motor vehicle and a safety device such as a retractor or buckle for a safety-belt. The force limiter is intended to “yield”, when subjected to a force in excess of a threshold, whilst providing a force which resists the force that initiated the “yielding”.

The ideal force limiter should yield with a uniform characteristic. That is to say, once a force in excess of the threshold is applied to the force limiter, the force limiter should extend or “yield” whilst providing a constant resistive force. It is not ideal if, once the predetermined threshold has been reached, the force limiter “yields” with no resistance to the force.

Also a force limiter should not be capable of extending indefinitely or, worse still, extending over a predetermined distance whilst providing a resistive effect and then becoming totally released.

Reference may be made to US-A-3,195,685 which shows a force limiter in which a pair of parallel thick wires, connected to a safety device, pass partly round a fixed bar. When a force in excess of a predetermined force is applied to the wires, they slide past the bar until the ends of the wires have slid past the bar, when the safety device becomes totally released.

The present invention seeks to provide an improved force limiter.

According to this invention there is provided a force limiter arrangement, the force limiter arrangement comprising a first element adapted to be connected to an anchoring point, and a second element adapted to be connected to a component which is to be permitted to move away from the anchoring point, one of said elements incorporating a member presenting a substantially cylindrical exterior, the other of said elements incorporating a pair of wire bar portions which are each at least partially wound around the member presenting the cylindrical outer surface so that the wire bar portions will be deformed with a force limiting effect as the said elements move apart, there being stop means to limit the distance by which the elements may move apart.

Preferably the two wire bar portions form opposite ends of an integral wire bar, there being a loop formed substantially at the mid point of the bar, the loop being connected to the rest of the relevant element.

Conveniently the rest of the relevant element includes a plate, the loop being connected to the plate by means of a connecting element of a rivet.

In one embodiment the stop means is constituted by terminal free end parts of the two wire bar portions.

Preferably the terminal ends of the wire bar portions are inwardly directed to contact each other, and are secured together.

In an alternative embodiment the stop means are constituted by at least one flange connected to the wire bars adapted to move therewith, said flange having an aperture formed therein through which the member presenting the cylindrical outer surface passes, the member presenting the cylindrical outer surface initially being located adjacent one end of the aperture, the arrangement being such that the other end of the aperture may engage the member presenting a cylindrical outer surface to constitute said stop.

Preferably a plate is provided associated with the wire bars, that plate having two upstanding flanges provided at opposed side edges thereof, each flange having a said elongate aperture therein, the member presenting the cylindrical outer surface passing both said apertures.

Conveniently the member presenting the cylindrical outer surface is mounted in position between two apertured lugs, said lugs being provided on opposed side edges of a plate, the plate being provided with an aperture to constitute connection means.

Advantageously one element is connected to an anchoring point, and the other element is connected to part of a safety-belt system. Thus the other element may be connected to a buckle adapted to receive tongue, or may be

connected to a pillar loop, or may be connected to a retractor reel, or a webbing grabber.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described by way of example with reference to:

FIGURE 1 which is a perspective view of a first embodiment of a force limiter in accordance with the invention prior to a force being exerted,

FIGURE 2 is a view corresponding to Figure 1 illustrating the situation after a force has been exerted,

FIGURE 3 is a perspective view of a second embodiment of a force limiter in accordance with the invention prior to a force being exerted, and

FIGURE 4 is a view corresponding to Figure 3 illustrating the situation after a force has been exerted.

Referring initially to Figure 1 of the accompanying drawings, a force limiter 1 is adapted to be mounted in position between an anchoring point provided on a motor vehicle, and a tongue provided on a safety belt.

The illustrated arrangement comprises a support plate 2 provided with an aperture 3 adapted to receive a bolt to secure the support plate 2 to a fixing or anchoring point provided on the chassis of a motor vehicle.

Integrally formed with the support plate 2 are two aligned upstanding lugs 4,5 which are provided on opposite sides of the support plate 2. The

upstanding lugs 4,5 are apertured, and extending between the apertures is a member 6 which presents a substantially cylindrical outer surface between the lugs 4,5. The member 6 may be a rod, or may be tubular.

It is preferred that the member 6 presents a smooth cylindrical outer surface of circular cross-section, but the cross-section could, in alternative embodiments, be multi-faceted - for example of octagonal cross-section.

Shown in Figure 1 is the operative part 7 of a buckle adapted to receive a tongue 8 which is connected to a safety belt. The operative part 7 of the buckle is securely connected to a plate 9. A rivet 10 passes through the plate 9, and secures to the underside of the plate 9, in the condition shown in Figure 1, a loop 11 formed substantially at the mid-point of an elongate wire bar, so that two generally parallel wire bar portions 12,13 extend away from the loop 11 (The loop 11 is shown more clearly in Figure 2). The rivet engages the loop and the plate. The two wire bar portions 12,13 are each caused to pass under the member 6 presenting the cylindrical outer surface, and are then wrapped one complete turn around the member 6, in the same sense, with the parts of each wire bar closest to the loop 11 being located towards the centre of the member 6 having the cylindrical outer surface, whilst the parts of each wire bar 12,13 which are furthest from the loop 11 are located outwardly of the centre of the member 6 having the cylindrical outer surface towards the lugs 4,5.

The wire bars 12,13 extend away from the member 6 having the cylindrical outer surface on the side thereof which is remote from the loop 11, but in an alternative embodiment of the invention may be further wrapped around the member 6 presenting the cylindrical outer surface so that each wire bar executes more than one complete turn around the member 6 presenting the cylindrical outer surface.

The terminal ends of the two wire bars 12,13 are directed inwardly to contact each other, and in the described embodiment they are connected together with a weld 14, thus forming a stop.

It is to be appreciated that when a force is applied to the tongue 8, if the force exceeds a predetermined threshold, which is sufficient to overcome the inherent strength of the bars 12,13, the plate 9 will begin to move away from the support plate 2, and the associated lugs 4,5, and the bars 12,13 will deform around the member 6 presenting the cylindrical outer surface. It has been found that after the initial force has been applied, which is sufficient to start the bars 12,13 deforming, the resistance to movement provided by the bars is substantially uniform as the plate 9 moves away from the support plate 2.

As can be seen from Figure 2, when the plate 9 has moved away from the support plate 2, by a predetermined distance, the inwardly directed ends of the bar which are connected with a weld 14, contact parts of the bars 12,13 which surround the member 6 having the cylindrical exterior, and thus act as a stop to prevent the plate 9 moving any further away from the support plate 2.

It is thus to be appreciated that a force limiter is provided which incorporates, in the described embodiment, relatively few components. Nevertheless, the force limiter provides a desired characteristic in that when a predetermined force is exceeded, tending to move the plate 9 away from the support plates 2, the plate 9 is permitted to move away from the support plate 2, but with a substantially constant resistive force being exerted. When the plate 9 has moved a predetermined distance from the support plate 2, the plate 9 is prevented from moving further by the operation of the "stop" described above.

Figure 3 illustrates a modified embodiment of the invention. In the embodiment illustrated in Figure 3, a substantial proportion of the components are as described above in the embodiment of the Figures 1 and 2, and those components will not be described further.

It is to be noted, however, that in the embodiment of Figure 3, the bars 12,13 which are wrapped around the member 6 presenting the cylindrical outer surface do not have their end portions interconnected by means of a weld, but instead have free ends portions 20,21.

An additional plate 23 is provided which is connected to the plate 9 by the rivet 10, but is spaced therefrom by the loop 11. The plate 23 extends substantially parallel with and in contact with, the support plate 2. The plate 23 has two upstanding flanges 24,25 provided on the opposed side edges thereof, and the flange 24 has an elongate oval aperture 26 therein, whilst the flange 25 has an elongate oval aperture 27 therein. The member 6 presenting the cylindrical exterior passes through one end of each of the apertures 26,27, since the flanges 24,25 are located immediately adjacent the lugs 4,5 which are provided on the support plate 2.

The force limiter has the initial condition illustrated in Figure 3. When the tongue 8 is subjected to a substantial force, the plate 9 moves away from the support plate 2 and the wire bars become uncoiled from their initial condition, thus providing a force resisting the movement of the tongue 8. It is to be appreciated that as the tongue 8 moves, so the plate 23 moves, until the ends of the elongate apertures 26,27 which are initially remote from the member 6 which presents the cylindrical outer surface, actually come into contact with that member 6. This prevents the plate 9 moving further away

from the support plate 2. Thus, the flanges provided with the apertures 26,27 constitute "stops".

Whilst, in the described embodiment, the force limiter is adapted to be mounted between an anchor point on a vehicle and a buckle on a safety-belt, it is to be noted that alternative embodiments may be connected between an anchoring point and other items that form part of the safety-belt system such as a retractor mechanism, or a pillar loop.

CLAIMS:

1. A force limiter arrangement, the force limiter arrangement comprising a first element adapted to be connected to an anchoring point, and a second element adapted to be connected to a component which is to be permitted to move away from the anchoring point, one of said elements incorporating a member presenting a substantially cylindrical exterior, the other of said elements incorporating a pair of wire bar portions which are each at least partially wound around the member presenting the cylindrical outer surface so that the wire bar portions will be deformed with a force limiting effect as the said elements move apart, there being stop means to limit the distance by which the elements may move apart.
2. An arrangement according to Claim 1 wherein the two wire bar portions form opposite ends of an integral wire bar, there being a loop formed substantially at the mid point of the bar, the loop being connected to the rest of the relevant element.
3. An arrangement according to Claim 2 wherein the rest of the relevant element includes a plate, the loop being connected to the plate by means of a connecting element.
4. An arrangement according to any one of the preceding Claims wherein the stop means is constituted by terminal free end parts of the two wire bar portions.

5. An arrangement according to Claim 4 wherein the terminal ends of the wire bar portions are inwardly directed to contact each other, and are secured together.
6. An arrangement according to any one of Claims 1 to 3 wherein the stop means are constituted by at least one flange connected to the wire bars adapted to move therewith, said flange having an aperture formed therein through which the member presenting the cylindrical outer surface passes, the member presenting the cylindrical outer surface initially being located adjacent one end of the aperture, the arrangement being such that the other end of the aperture may engage the member presenting a cylindrical outer surface to constitute said stop.
7. An arrangement according to Claim 6 wherein a plate is provided associated with the wire bars, that plate having two upstanding flanges provided at opposed side edges thereof, each flange having a said elongate aperture therein, the member presenting the cylindrical outer surface passing both said apertures.
8. An arrangement according to any one of the preceding Claims wherein the member presenting the cylindrical outer surface is mounted in position between two apertured lugs, said lugs being provided on opposed side edges of a plate, the plate being provided with an aperture to constitute connection means.
9. An arrangement according to any one of the preceding Claims wherein one element is connected to an anchoring point, and the other element is connected to part of a safety-belt system.

10. A force limiter arrangement substantially as herein described with reference to and as shown in Figure 1 and 2 of the accompanying drawings.

11. A force limiter arrangement substantially as herein described with reference to and as shown in the Figures 3 and 4 of the accompanying drawings.

12. Any novel feature or combination of features disclosed herein.



Application No: GB 9910297.2
Claims searched: 1-11

Examiner: Richard Collins
Date of search: 11 October 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): B7B BVRQ, BVRR.

Int Cl (Ed.6): B60R 22/28, 22/34, 22/46.

Other: Online WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	WO 97/37876 A1 (COENEN) figures 1 and 9 to 11 and page 6.	1-3,9
A	US 4358136 A (TSUGE ET AL) figure 1 and columns 3 and 4.	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.